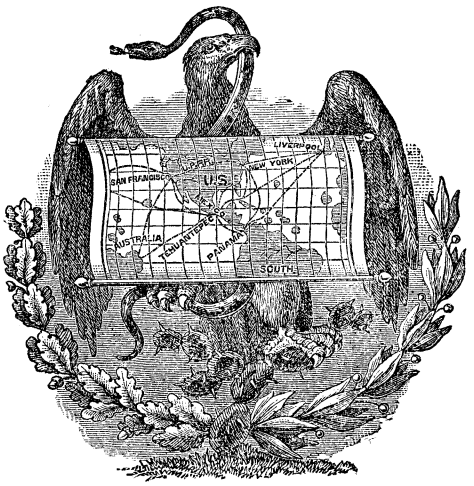


X.

THE NEW ROUTE OF COMMERCE BY THE ISTHMUS OF TEHUANTEPEC.*

BY SIMON STEVENS.

READ NOVEMBER 15TH, 1870.

MR. PRESIDENT, LADIES AND GENTLEMEN: The history of the lines of commerce is the history of the world. The paths of trade, radiating from the centers of wealth and civilization, are and always have been the channels through which the mental and moral wealth of nations has been disseminated.

* Since the above paper was read, the following additional interesting reports have been received:

a The Tehuantepec Railway and Ship Canal; *b* the Tehuantepec Railway and Tributaries; *c* Interoceanic Movements, which will be found at the close of this paper.

With the creation, deflection or interruption of main lines of traffic, cities, and even nations, have arisen from poverty and weakness to wealth and power, or from power and wealth have descended into obscurity and ruin.

It is to some of these lessons taught us by history that we now ask your attention.

The East, the old homestead of the human family, the richest and most populous portion of the earth, has ever been considered the fountain of commerce. Its trade has from time immemorial stimulated the West, and enriched those communities which have participated in it.

Europe is of yesterday, and America of to-day, but who shall count the wrinkles on the brow of Asia, or tell the wealth which her commerce has produced?

When we speak of the East, we mean India, China, Japan, and "the Isles of the Sea," with possibly a dreamy notion of Persia and Asia Minor. These, indeed, are the commercial Asia of to-day, but we have reason to believe that other empires as mighty, as busy with trade, and as brilliant as these, with great cities and productive provinces, have faded from sight. Those in Central and Western Asia were destroyed, not so much by conquering Attilas and Tamerlanes as by the interruption or changes of ancient lines of traffic. Pekin and Yeddo remain in the distant East, but where are Babylon, Nineveh, Tyre, Cairo, Thebes, and the countless cities whose ruins only remain as witnesses of their former existence?

If we may credit history, the mighty hand of war was laid upon them again and again, but the day of their final desolation did not come until the caravans of the East had found new depots and new lines of transit. Successive conquerors might lay waste Tyre, Sidon and Damascus; but so long as the trade between the East and the West required them, they were sure to rise again with startling rapidity. Arbitrary power and the keen political sagacity of Alexander of Macedon, as early as the fourth century before Christ, diverted the trade of his

Asiatic dominions through the Red Sea and the Nile to his newly-built city of Alexandria. The prosperity of that commercial emporium was so well established that to this day the dream of the Greek conqueror continues to be fulfilled.

In fact, it would be difficult to find a more complete illustration of the laws of trade to which we are directing attention than in the fluctuating fortunes of this Egyptian port, which seems now to have received a new impetus from the reopening of the Suez Canal, which seems likely to restore to it much of its earlier prosperity.

The peculiar character of the commerce of the ancients and the character of the goods transported, at least for long distances, made it possible to conduct it, for the most part, by overland routes, while the sea was comparatively neglected. It is indeed probable that the canal, between the Red Sea and the Mediterranean, as it was originally planned under the Pharaohs, was but an effort to restore artificially a channel which nature herself had provided in an earlier period of the world. Whether or not the Phœnicians under Pharaoh Necho, or the later Greeks, effected the circumnavigation of Africa, there was nothing in the ordinary commerce of that day to call for or employ such a prolonged and perilous route; so, therefore, traffic adhered to its caravans and short voyages. It will be gathered from this how very considerable must have been the commerce of those days between the countries bordering the Mediterranean and Eastern Asia, including the isles of the sea, to cause so many vast cities to spring up in the desert and flourish by the tariffs and tolls of a carrying trade.

At the beginning of the Christian era, all that was then known of Europe, Africa and Western Asia was ruled by or was tributary to the Roman Empire. The subsequent growth of Christianity seemed to be, in a manner, circumscribed by its eastern limits. Centuries later, the Greek Emperors of Byzantium managed to revive and keep

open the routes of Asiatic commerce, even after the fall of the Western Empire, chiefly because of the decadence of the commercial cities of Egypt. The successive struggles and rebellions which desolated Asia Minor were but the efforts of mighty robbers to acquire the right and the power to levy tribute on the trade between the East and the West.

In the seventh century a power began to make itself felt in the earth, which, in at least its earlier career, was less a robber than a destroyer. Its success operated not so much to transfer the ancient lines of commerce to new hands, as to monopolize them altogether. The followers of Mahomet cared less for trade than power, their aim being to establish the Koran by the sword. One by one the Christian States and cities of Western Asia and Northern Africa went down before the Moslems, and wherever their authority was extended all traffic with the Christian world to the westward was transferred to their keeping, so that though goods passed with heavy tribute, all news from whence they came was cut off.

A description of the position of the commercial world about the time of the culmination of the Moslem power on its western borders, less than four hundred years ago, has been clearly stated by a recent writer substantially in the following words:

According to Ptolemy, the best recognized authority, whose geography had stood the test of 1,300 years, the then known world was a strip of some seventy degrees wide, mostly north of the equator, with Cadiz on the west, and farthest India, or Cathay, on the east, lying between the frozen and the burning zones, both supposed to be impassable by man. The inhabitants, so far as known in Europe, were Christians and Mohammedans, the one sect about half the age of the other. Christendom, the elder, that once held considerable portions of Asia and Africa, had been driven back inch by inch in spite of the Crusades, even from the Holy Land, the place of its birth, up

into the north-west corner of Europe; and, both in lands and people, was outnumbered six to one by the followers of Mahomet. For seven hundred years the fairest provinces of Spain acknowledged the sway of the Moors; and the Mediterranean, from Jaffa to the Gates of Hercules, was under their control. The Crescent was constantly encroaching on the Cross, while Christendom, schismatic, dismayed, demoralized and disheartened, seemed almost incapable of further resistance.

The several routes of commerce to Asia beyond the Ganges, via Venice and Genoa, by the Red, Black and Caspian Seas, through Persia and Tartary, were one by one closed to Christians.

The profits of the overland carrying trade, what there was left of it, were mostly in the hands of the Arabians; but Memphis, Thebes and Cairo, which had once flourished by that trade, had declined as it fell off in amount, and yielded its poor remains to Alexandria, nearer the sea. Finally, in 1453, Constantinople, the Christian city of Constantine, fell into the hands of the Turks, and with it the commerce of the Black Sea and the Bosphorus, the last of the old trading routes from the East to the West.

So far as Europe was concerned, Asia had almost disappeared from the commercial world. From that time forward the almost incessant wars between the followers of the Crescent and the wearers of the Cross rendered anything like commerce to the last degree precarious and unsatisfactory, while the narrow and blinded policy of the Mohammedan potentates almost prevented them from employing, even for their own benefit, the splendid prizes which they had won. Comparatively small as was the trade thus permitted, and hampered as it was by perils, losses and enormous cost, it was still sufficient to maintain for ages the splendors of Stamboul, and to continue for years the prosperity of Venice, Genoa and other Italian trading towns. This trade, though Asiatic, was but to a small extent Oriental, in

the true sense of the word. Though the silk and rich manufactures of China and Japan, and the "spices" of the Moluccas found their way to the remotest parts of the West, even to fair Albion, yet the consumers cared little to inquire whence they came beyond Venice or Genoa; for all beyond was shrouded in mystery.

Through all the darkness of the middle ages there were left some studious inquirers into the history of the past, and some sagacious prophets of the future, who were by no means ignorant of the great commercial causes which had from time to time built up and destroyed the old trading stations. Hence, the fall of Constantinople to the Christians of the West, especially those of Portugal and Spain, was but the signal of renewed energy to reopen the old paths of trade, or seek out new ones in order to secure direct participation in the fabled riches of the East.

The Spanish queen, whose steady heroism and religious enthusiasm sustained Spain in her long struggle against the Moors, was the same Isabella, who, as soon as she could take her breath after the fall of Grenada, in 1492, sent for Columbus, her old suitor, almost as exhausted as were her own royal coffers, and said to him, "Now, sir, we will attend to you," offering to pledge her private jewels for his outfit.

Columbus was more than successful, and thus the same memorable year that gave to Mohamedanism its first check in Europe, gave to Christendom a new world. There were many men at the battle of Lepanto who afterwards distinguished themselves as American discoverers and explorers.

The blind wrath of Moslem bigotry, and the oppressive exactions of Moorish avarice, operating as we have seen to close the old gateways of the East, were destined thus indirectly to promote the accomplishment of results whose magnitude it is difficult to comprehend. Truly the ways of God are past finding out. How often He rewards earnest discoverers with inventions they sought not! The

Almighty who permitted the False Prophet to scourge a corrupt and debased Christendom, also permitted the nations who had fled before the Crescent to find a new world while searching for the fabled East of the old.

The van of the new era of discovery seems to have been led by Portugal, whose peculiar position in the south-west corner of Europe, with the boldly projecting coast of Africa trending away south-westerly below her, must naturally have suggested the direction which her exploration should take. As early as 1454, the captains of Prince Henry of Portugal, surnamed "the Navigator," began this work in earnest, and by 1463 they had pushed their discoveries as far as Sierra Leone. That year, Gibraltar was captured by the Spaniards, and Prince Henry died. King Alphonso and King John pressed forward the work, so that by the year 1487, after nearly seventy years blindly groping down the coast of Africa, Bartholomew Diaz had pushed southward through the tropics so far as the Cape of Good Hope, thus bursting forever the barrier of ignorance and fear which had sealed the southern gateway of the Indian Ocean. Still it was another ten years before Vasco de Gama rounded that stormy cape and found his way to Calicut. The fact that this glorious event occurred just five years after Columbus had successfully balanced his egg, it must be confessed somewhat dimmed the splendor of its novelty.

A triumph truly these two routes to the East, and the beginning of a new era in commercial history; but Christians were only a short step in advance of their Moslem foes. The policy of Portugal and Spain was narrow and restrictive. What each discovered she strove jealously to guard for herself. The new Portuguese route to Asia was meant to be as confirmed a monopoly as were the old paths in the iron gripe of the Commanders of the Faithful. Spain was not more liberal.

But a new order of things was rapidly approaching. In 1453, when the Moslems captured Constantinople, and

finally closed the trade of Asia to the merchants of Christendom, Columbus was a lad of six years at Genoa, Vespucci of two years at Florence, and John Cabot a youth at Genoa; but to these three Italian boys the world was yet to owe an immeasurable debt. While they were growing up in years of wisdom, the nations which were to employ them were also growing. While Columbus was slowly developing his convictions of the true shape of the earth and the true route to the Indias, Spain was grappling with the Moors in the closing scenes of that war of centuries, from which she emerged so gloriously. As victory enhanced the pride and ambition of the rising nation, the achievements of the neighboring kingdom were looked upon with more and more of envious emulation, until at last, after long and wearisome waiting, Columbus obtained the scanty means wherewith to promote this rivalry of Portugal. The Pope, a native of Spain, wishing to reward his former sovereigns for their persistent struggle against the Moors, forgetting the promises of his predecessors to the kings of Portugal, and not remembering that there were other Christians outside the Peninsula endued with Christian greed and enterprise, divided the world between them, after the manner of a more ancient potentate, and fortified this monopoly by the boldest of papal Bulls.

You and I, standing where we do to-day, on the land which Columbus discovered, have by no means yet comprehended the full measure of his success, nor can we ever approximate to such a comprehension unless we place ourselves in the mental position of Columbus, and adopt as our own his dreams.

From first to last Columbus never so much as thought of discovering a New World. He did but plan a new route, whereby Europe might once more enjoy the wealth-giving commerce of Asia beyond the Ganges, and he died in the belief that he had indeed accomplished his purpose. For more than twenty years after his first tri-

umphant voyage the Christian world shared in the belief of the great navigator. Henry VII granted a license to the Cabots to open a north-west passage, and when they discovered Newfoundland and other islands, they took possession of them as outlying islands of China or Japan. The Anglo-Saxon race has not ceased to hunt for that north-west passage.

When, in 1498, Columbus touched the shores of Venezuela he understood that the natives called the land "Paria,' and he reasoned himself into the belief that this was the Paradise from which our first parents were driven. He and everybody else believed that these new lands and islands were in Eastern Asia.

So thoroughly had the one idea taken possession of the minds of men that, for a century more, the coast of the Western Continent was explored by the adventurers of all nations, less for the riches itself might contain, than for that invaluable strait which should penetrate the mighty barrier and allow the trade of Europe to sail on westward to the golden land of commerce. We who assume the same controlling conception, as our peculiar legacy from our adventurous ancestors, will not be long in finding that it is of greater significance and brighter promise to us than it could be to the merchants of any European metropolis.

In 1513, Balboa first looked out from the mountains of Panama upon the waters of the Pacific, and in 1519 Magellan sailed through the perilous straits which still bear his name, but it was a century later (1619) before they rounded Cape Horn, in their passage onward to the true Spice Islands and the real Orient. Meanwhile the persistent and daring pursuit of this geographical *ignis fatuus* of a natural strait led to a more thorough and practical acquaintance with North and South America than would otherwise, probably, have been obtained. Every bay and inlet was explored. The St. Lawrence, the Hudson, Delaware, Chesapeake, Mississippi, Coaza-

coalcos, Atrato, Amazon, Rio de la Plata, and other rivers were ascended with varied experience of suffering and adventure. Science profited greatly and the maps grew and multiplied, but each consecutive effort to penetrate the American Continent resulted in failure. It is true that Cortez conceived the idea of a ship canal from sea to sea at Tehuantepec, but the world was not yet ripe for it.

For three centuries and a half the commerce of Europe with Asia beyond the Ganges has toiled around the Cape of Good Hope. The well-won prestige of Portugal was wrested from her by the Dutch, French and English, who became involved in a protracted and varying struggle which eventuated in the all but undisputed predominance of Great Britain in the commerce of the East. Lisbon rose to commercial importance only to sink again, while Antwerp, Amsterdam, Liverpool and London attained their wealth by the management of a trade which at once reminds us of Tyre and the cities of Western Asia and Egypt.

From the very first, Spain assumed no share in the use of the African route; for, in 1493, within three months from the return of Columbus, Alexander VI, a Spaniard, a pope of not a year's standing, wishing to reward Ferdinand and Isabella for their struggles in expelling the Moors, divided our globe into two parts, by an imaginary line of demarcation passing from pole to pole, one hundred leagues west of the Azores and Cape Verd Islands, giving to Spain all she could discover within 180° to the west of it, leaving to Portugal all her African discoveries and the Indies for 180° east of it. After much dispute it was finally settled that the line should stand at three hundred and seventy leagues west of the Azores. Hence, it will be seen how Portugal came to possess and settle the eastern part of Brazil, and why Spain confined her operations to countries west of the Line, and made no

attempt to interfere with Portugal's African route or possessions.

It is now over three centuries and a half since the way around the Cape of Good Hope was discovered, and during all that time the trade of Europe with Central and Eastern Asia has steadily increased in volume and value. Every effort has been made to shorten the long voyages and add to their security; but, until these later years, the domains of the Sultan have presented the same impassable barriers that they did when Vasco de Gama made his voyage round Africa to India, while behind them lies what we may call the "dead lands" of Arabia, Persia, Afghanistan, Beluchistan and Turkestan, now receiving the fostering attention of Russia.

Not only was the trade increasing, but vital changes were slowly taking place, especially within the present century, and the Asiatic question is not now what it was three hundred years ago.

English enterprise has secured to itself a vast Eastern empire, including the richest provinces of Central and Peninsular India. In Australia and the adjacent islands, a new Anglo-Saxon Commonwealth, more easterly than Cathay itself, is a new commerce springing up of vast extent. The lines of commerce are straight lines, seeking the shortest, quickest and cheapest transits possible; hence, San Francisco and Tehuantepec must eventually become the Tyre and the Alexandria of our age. America has indeed broken down the ancient barriers of the oldest empires of the world, and our future commerce with India, China and Japan bids fair to become extensive.

The great minds which direct the mercantile interests of Europe have never for a moment been blind to the dazzling future. The great commercial powers have been steadily aiming to grasp the prize. Russia has been pushing her conquests in the East up to the Chinese frontier, building long lines of railway stretching eastward, while year by year her trading fleets are increasing upon the

Black Sea and the Caspian. England has increased her ocean steam services, shortened her lines of transit, built swifter vessels, and multiplied her Indian railways; while France, with a bolder and deeper insight into the future needs of trade, has been negotiating and toiling for the resurrection of one of the most ancient routes of commerce, the canal (once perhaps a natural strait) across the narrow neck of land which connects Asia with Africa, and separates the Red Sea from the Mediterranean. Diminished as is the value of the Suez route by the difficult navigation of the Red Sea, the drifting sands of the desert, and the gentle and variable winds of the Mediterranean, there can be little doubt that, so far as Europe is concerned, her trade with the East has entered upon a new era, which will probably ere long work considerable change in the relative positions of the commercial powers. One at least of the paths which were shut by the Moslem conquerors has been reopened to the trade of the world, and it is morally certain that others will follow in due time.

The toiling caravans are to be replaced by the rail and the steam-engine, while swift propellers will penetrate the African Isthmus instead of the clumsy barges of the Egyptians, or the triremes of the Ptolemies, the Romans and the Caliphs; but only the methods of transit will be changed, for there will in all this be nothing new under the sun. Even if the railway and the telegraph call into life new empires and fresh marts of trade on the sites of the old Babylons, Ninevehs and Palmyras, all will but go to confirm the primeval law of human commerce, that "the trade of Asia is the wealth of nations."

We in America, heirs of the dream of Columbus, have not only our peculiar interest in all this; we have a plain but most important lesson to learn, and we shall do well by ourselves if we learn it promptly.

When the failure of all efforts to penetrate the American continent seemed to forever compel the commerce of

Europe to reach Eastern Asia by the African route, the peculiar relations of the American continent to the commercial geography of the world seemed to have been altogether lost sight of. Not a hundred years ago, a learned society of France seriously debated the question whether, on the whole, the discovery of America had been of advantage to the world—that is, probably, to France. But now, even though the nations of western Europe have found in the fast-expanding trade of America still another "Orient" from which to drain wealth for their capacious coffers, they seem to have utterly ignored or failed to comprehend the fact that America is, after all, not only a part of the world, but rapidly becoming the acknowledged central continent of it, and must hereafter hold the keys of commerce.

All these years, however, the New World has been steadily growing in population, wealth and a correct understanding of its own interests, until now. At the end of these three and a half centuries, during which Europe has overlooked us, there has been developed here a commercial power overshadowing both coasts of the continent, and fully competent to take into its own control the guidance of the commercial future of this hemisphere.

The United States of America are deeply interested in all movements aimed at the creation of new or the deflection of ancient lines of traffic between Western Europe and Eastern Asia.

Let me here call your attention to a few considerations, drawn from the physical structure of the two continents of North and South America. Some facts are open to the most superficial observer. It is evident that North America is not only very much the larger, but that it lies wholly within that northern hemisphere which contains the population, the history and the commerce of the globe. It lies, moreover, almost altogether to the westward of South America. The meridian of Washington

almost escapes the western coast of South America, while the meridian of Cape Horn passes to the eastward of the United States altogether. Tehuantepec is near the longitude of Omaha. A ship bound from New York to San Francisco is compelled, in rounding Brazil and doubling Cape Horn, to sail further eastward than the entire direct distance between the two cities.

Do not suppose for a moment that South America, with her undeveloped wealth, is to have no share in the western commercial system. Her position is such as to vastly increase her commercial value and intimate connection with both coasts of North America, so soon as our own nation shall have provided ample interoceanic communication. At present the countries of three-fourths of the South American coast are nearer, by steam or sail, to the ports of Europe than to the Atlantic harbors of the United States; nor are our Pacific ports better situated in this respect.

When the slow and arduous task of ascertaining the true nature of the geography of the Americas was accomplished, and the fact was unwillingly accepted that nature had left no break in the rugged barrier which extended from the frozen sea of the north to the Straits of Magellan, and even sooner, the quick and fertile brains of the early navigators grasped the conclusion that what nature had omitted must be supplied by the ingenuity and courage of man.

The thought was promptly supplemented by deeds of exploration so daring, so judicious and so exhaustive, that, if the records of their observations, now at Madrid, should at this day be examined, we should require but little additional information on the American Canal question. What Spain already knew of the continental nature of the regions which widened away to the north and south, though vague and faulty, was sufficient to restrict her surveys to the irregular reach of narrow land

which extends between Tehuantepec and Darien for more than seventeen hundred miles.

At many different points in this isthmian extent, enthusiastic explorers were positive of discovering an eligible point for the construction of transits from sea to sea, by ship canal or otherwise. Even then, the names of the Tehuantepec, Honduras, Nicaragua, Panama, Darien and Atrato routes were as familiar in the mouths of men as they are to-day.

There was then but one question to answer, and one problem to solve: "What is best for Spain? and by which of these routes, if more than one is practicable, can Spain best carry on her commerce with the Indies?" The requirements of an American commercial system were not thought of.

So far as American interests are concerned, Europe of to-day is as regardless of them almost as were the Spanish explorers.

The reason of this neglect is obvious, when we consider that hitherto a route for a canal has been sought by or through Europeans, and the merits of each locality have been considered only with reference to European commercial interests, and the employment of their own capital. This, too, has permitted a species of political blindness, preventing them discerning that that route only, which was best for the trade which needed it most, could be the most advantageous for all.

Let us once more turn to the map of North America.

At the centre of its southern projection, almost landlocked by the coasts of Cuba, Florida, Yucatan and the mainland, the Gulf of Mexico, the Mediterranean of America, is situate precisely where it can best answer the demands of American commerce.

The great interior river navigation of North America has its outlet through the Mississippi into the Gulf of Mexico; while a region larger and richer than all Europe, west of the Adriatic, is drained into its circling coast line. It is

impossible to over-estimate the importance of this inland sea, and it would be something akin to insanity to dismiss it from consideration in connection with such a subject as the development of the American system of trade.

Let us draw a line north and south as nearly as possible through the centre of North America. We find that it cuts the southern terminus of the Gulf of Mexico a little west of the peninsula of Yucatan, and at about the narrowest portion of the isthmus, which is on the meridian of the western border of the State of Missouri.

Here, and here only, can the trade of the Gulf of Mexico, and our swarming interior, together with that of the Atlantic and Pacific, as well as that of Asia and of Europe, be fully accommodated. If it be possible to construct at this point a railway and an available ship canal, nothing but the discovery of something approaching to a natural strait should carry us further to the southward, beyond Yucatan, or through the dangerous navigation of the Caribbean Sea. It should be borne in mind that the Isthmus of Tehuantepec is in latitude 18°, while that of Darien is but little more than 8°.

Nor should we for one moment lose sight of the solid truth that common carriers exist for the sake of trade, not trade for the sake of common carriers, and the end must in no case be sacrificed to the means.

In the determination of a question which involves interests of such magnitude as those which are now under discussion, no local jealousies, no minor considerations of individual profit or loss, can be entertained. Nothing less dignified than the development of a continent or the aggrandizement of a nation is entitled to a hearing. America will listen first of all to the United States, believing, at the same time, that the prosperity of the other political powers as well as all Europe is bound up in her own.

In peace, which may be regarded as the normal condition of our American national sisterhood, a ship canal

across the Isthmus of Tehuantepec would bring the Gulf ports nearer the harbor of San Francisco, by more than 2,500 miles, than would a similar work in connection with the Atrato at Darien. A similar advantage would be attained, in varied proportions, governed by respective localities, for the Atlantic ports of the United States and the commercial cities of western Europe. This continues true, in a greater or less degree, whether we compare the Tehuantepec with Darien, Nicaragua, Honduras, or any other proposed line of interoceanic transit. The trade lines from either coast of South America with either coast of North America, and of the entire west coast of our double continent with Europe, can be made to converge more advantageously at this point than any other. Nowhere else can all that vast preponderance of the Asiatic trade, which is compelled by Pacific calms, currents and trade winds to follow what is called the northern passage, accomplish such a saving, either in absolute distance or in the specific facilities of ocean navigation. The apparent gain which is presented by a superficial examination of the map is very largely augmented when we take into account those tropical calms and other phenomena which mark the eccentric ocean that separates us from China and Japan. If these truths are of such importance in their general application, so much the more do they become intensified when we consider them with reference to that incalculable commerce which, in that event, would converge toward and radiate from the shores of the Gulf of Mexico. No more vivifying stimulus could be given to the swift development of our southern tier of States; no greater boon could be conferred upon the valley of the Mississippi than a direct connection by water with our Pacific coast and Asia, nor, in these days of costly steamships, should any needless day or mile be added to the time or distance of their passage.

At the same time, selfishness itself forces upon us, as a not unimportant consideration, that no stronger stimulus

to her commercial system, no better guarantee of future prosperity, could be provided for our sister republic. The statesmen of Mexico have learned to look upon the Tehuantepec ship canal as one of the bright stars of hope in their national future.

It has been said that the history of the Suez Canal, extending back as it does to the time of the Pharaohs, Ptolemies, Roman Emperors and Moslem Caliphs, is a mine of archæological romance; but if that is true of the Egyptian transit, it may be repeated with tenfold verity concerning the central lands of America. Geological observers assure us that the very summit of the Isthmus of Tehuantepec is of coral formation. The rocks that tower above these deeply cut and winding passes, were once low islets, or submerged beneath the bosom of the western sea, and at their sunken bases the monsters of the deep played in and out where we propose to construct our artificial channel. Speculation loses itself at once in any attempt to imagine the precise configuration of this part of the continent at that early date, or the nature of the convulsions by which it was changed. We can hardly guess if the mouth of the Mississippi was not then hundreds of miles further to the north, on the margin of a great inland sea, whose outlet may have been at Tehuantepec, and into the western ocean instead of the Atlantic.

The recent researches of the Abbé Brasseur de Bourbourg have removed some points of Central American archæology from the realm of conjecture, and placed them among the established facts of science. Not only the Tehuantepec cliffs, but the mountains of the Atlantic coast range are of coral formation. The most wonderful of our observations, it may be, and the most interesting to Biblical scholars, is yet to come. Who will hereafter sneer at Noah's flood, when he learns that the mighty ruins of Yucatan point so distinctly to precisely such a general submergence? These ruins, rivaling in interest,

though perhaps not in extent, those of Egypt, are covered with hieroglyphical representations, evidencing a high degree of architectural and engineering skill. What, indeed, shall we say, except that the real history of the globe in which we live mocks at that which has been written, and laughs at the feeble light of what we are pleased to call "science." Well may archæologists ask, which is the *old* world?

Even so imperfect an allusion to the topography of the isthmus leads us to observations tending to correct a somewhat popular fallacy concerning the Tehuantepec route. While much of it lies through a virgin wilderness, and will encounter the obstacles appertaining thereunto, that very wilderness is itself a mine of wealth. Nowhere on the globe is there a healthier or more equable climate, in spite of its intertropical locality. Nowhere are there such boundless supplies of the most valuable woods known to the arts and mechanical necessities. Pine, oak, mahogany, logwood, lignum-vitæ, ebony and other valuable varieties of trees, are supplemented by the rubber tree, medicinal plants, dye-stuffs, and a soil which produces, in profuse abundance, coffee, indigo, cacao, tobacco, Sisal hemp, bananas, oranges and endless tropical fruits. A large portion of this region was under luxuriant cultivation by the hands of white men, while yet the spot whereon we stand was an unbroken wilderness. Here, on the banks of the Tehuantepec, Cortez selected his own estates as being the very garden of Mexico, and the surest fortune for his descendants. Nor was he at all in error. To this day his broad lands are held by those who call him their direct ancestor, while even Republicanism calls his estates "the Marquisanas." Back among the hills and mountains lie towns and villages, with churches that date back over three centuries, while hidden in the primeval forests are the majestic ruins of a yet more ancient civilization, older than the

Spanish Conquest, older than the Aztec monarchy, older perhaps than Karnak or Thebes.

I have dwelt upon this feature of the isthmus country to better develop an important desideratum which cannot be so well supplied by any of the other routes proposed, to wit, the sure development of local population, wealth, trade and agriculture upon these lines of interoceanic transit. Not alone would such a development create a local protectorate and guardian of the great work itself, but would rapidly provide sufficient resources of supplies, repairs and other benefits to passing navigation, which could only be secured at great expense and continual uncertainty in localities less favored or more remote.

This region has at present no outlet—no regular communication with the outside world. Give it these. Give the people education, with toleration in religion, and you establish at once all the conditions of life, growth and power.

Such, briefly, are some of the ascertained advantages of the Tehuantepec route in time of peace, and the most thorough and searching examination will but make them more strikingly manifest.

The history of the world compels us to assume war as one of the sure prophecies of all national future, and that misfortune will occur to some one or other of the commercial powers interested in the American interoceanic transit as certainly as the sun rises and sets. Let us hope that our own beloved land may not be involved, but only fatuity could allow us to lose sight of even that sad possibility.

In the event of war among any of the maritime powers, it will be of the first importance to all the rest that so necessary a commercial highway should be kept sacred to the interests of peace, and not become, in the hands of weak or interested States, an object of warlike ambition or a scene of military operations.

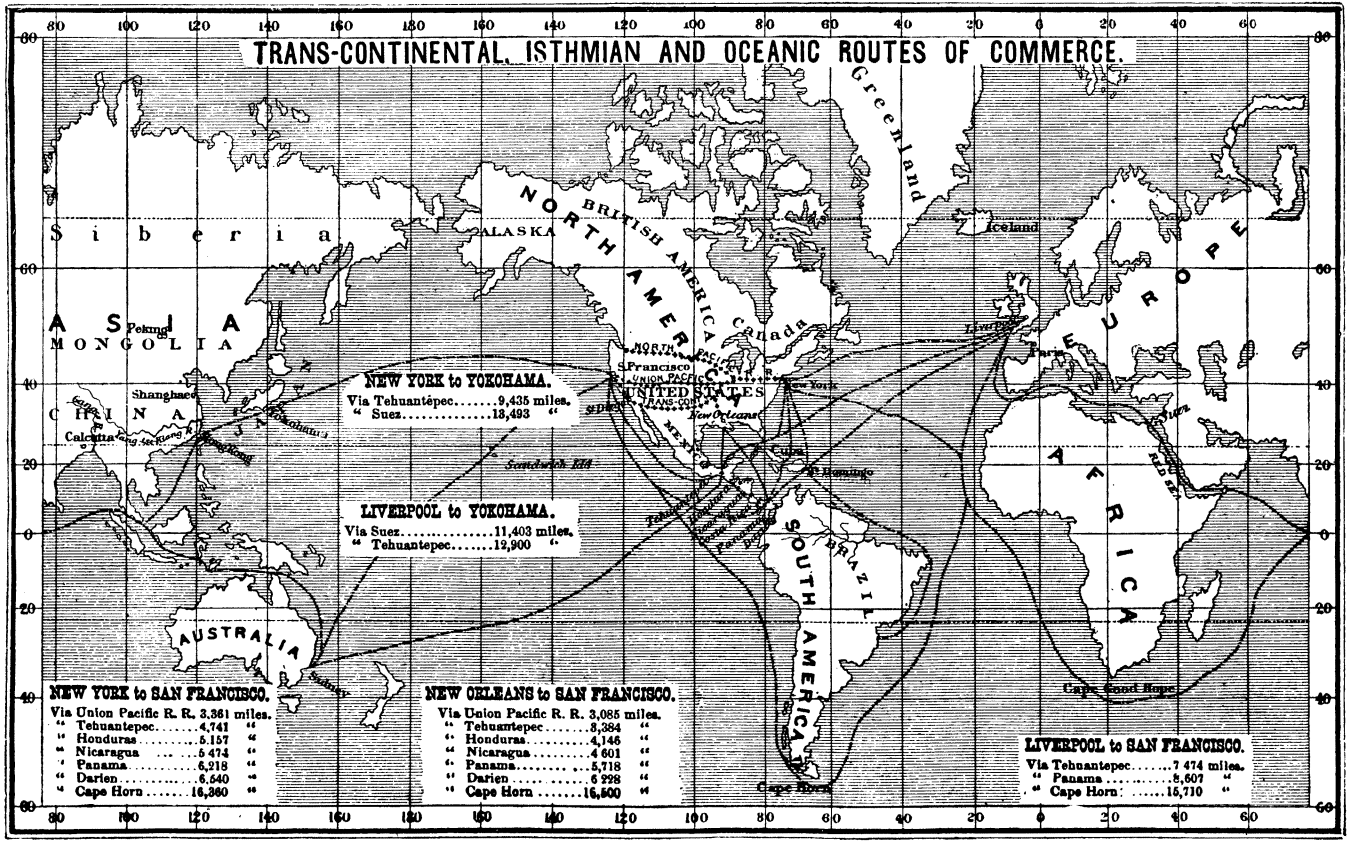
Neither of these great ends could be assured should the proposed canal be located to the southward of the peninsula of Yucatan.

On the other hand, the land-locked character of the Gulf of Mexico, and the narrow and difficult navigation of its outlets on either side of the Island of Cuba, would make this nation, conjointly with Mexico, the guardian and guarantor of a canal which opened upon the Gulf; and it would be difficult to over-estimate this advantage. We could not even approach a due conception of its importance without lifting the veil from our national future and peering prophetically in among the eventful centuries yet to come.

In war, then, as in peace, the necessities of our commercial developments, the self evident economies of trade, the dictates at once of broad statesmanship and prudent patriotism, point unmistakably to the Isthmus of Tehuantepec as the best of all localities for the construction of our interoceanic ship canal.

We have assumed, what we fully believe to be true, that a canal at Tehuantepec would be of more value to the United States and to the world than a similar canal at any other point to the south of it, and explorations have demonstrated the fact that at no point is it possible to make a through-cut from sea to sea. Such would be a preposterous undertaking in the way of mammoth cuts and tunnels, and would carry both cost and engineering into a region of dreamy and fanciful extravagance.

The Tehuantepec project, on the other hand, only presents difficulties precisely similar to those which have already been overcome with ease in other ship-canal undertakings in various parts of the world.


TRANS-CONTINENTAL, ISTHMIAN AND OCEANIC ROUTES OF COMMERCE.
NEW YORK to YOKOHAMA.
Via Tehuantépec.....9,435 miles.
" Suez.....13,493 "
LIVERPOOL to YOKOHAMA.
Via Suez.....11,403 miles.
" Tehuantepec.....12,900 "
NEW YORK to SAN FRANCISCO.
Via Union Pacific R. R. 3,361 miles.
" Tehuantepec.....4,741 "
" Honduras.....5,157 "
" Nicaragua.....5,474 "
" Panama.....6,218 "
" Darien.....6,540 "
" Cape Horn.....16,360 "
NEW ORLEANS to SAN FRANCISCO.
Via Union Pacific R. R. 3,085 miles.
" Tehuantepec.....3,384 "
" Honduras.....4,146 "
" Nicaragua.....4,601 "
" Panama.....5,718 "
" Darien.....6,928 "
" Cape Horn.....16,500 "
LIVERPOOL to SAN FRANCISCO.
Via Tehuantepec.....7,474 miles.
" Panama.....8,607 "
" Cape Horn.....15,710 "
Siberia
ASIA
MONGOLIA
CHINA
Pekin
Shanghae
Calcutta
AUSTRALIA
Sydney
NORTH AMERICA
ALASKA
BRITISH AMERICA
Canada
UNITED STATES
S. Francisco
New York
New Orleans
MEXICO
Cuba
St Domingo
Greenland
Iceland
EUROPE
London
Paris
AFRICA
Cape Good Hope
SOUTH AMERICA
BRAZIL
Cape Horn

APPENDIX.

REPORT.

(*a*) The Tehuantepec Railway and Ship Canal.

London, *October* 16*th*, 1871.

Simon Stevens, Esq.,

President of the Tehuantepec Railway Company, New York:

Sir.—The undersigned, appointed by you a commission to examine some of the principal artificial waterways in Europe, with a view of applying the best and most recent experience to the project for an interoceanic railway and ship canal across the Isthmus of Tehuantepec, Mexico, respectfully report, that a portion of our number have examined personally the Caledonian canal, the great Dutch ship canal now under construction for the purpose of establishing an easy and direct communication between the port of Amsterdam and the German Ocean, and also the less known, though very interesting, work now in progress at the Hook of Holland, viz., the new waterway from Rotterdam to the sea ("Waterweg van Rotterdam naar Zee").

The members of the commission have been courteously furnished with every facility for the examination of these interesting works. The Lord Advocate of Scotland, one of Her Britannic Majesty's commissioners of the Caledonian canal, kindly furnished us with letters to the officers in charge of the canal; the superintendent of which, Mr. Davidson, accompanied us, and explained the more interesting parts of the works. To the eminent engineer, Mr. Hawkshaw, and to his associate at Amsterdam, Mr. J. Dirks, we are indebted for the fullest information, together with plans of the Amsterdam ship canal, one of the most remarkable works of engineering of the present day. Mr. Dirks personally accompanied us in our examinations. To Mr. Caland, the chief engineer, and a member of the "Waterstaat" of Holland, we are

also indebted for the opportunity of making ourselves personally acquainted with the work at the Hook of Holland, as well as for documents and valuable information.

Want of time (owing to duties or engagements) has prevented personal visits to other great waterways, especially the Suez and Languedoc canals, which would be instructive in reference to a project for any new ship canal; but these works are so thoroughly described, their characteristics and details so well known, as to enable us to dispense with personal examinations. The various surveys and projects for ship canals at sundry points across the American Isthmus are, of course, familiar to, and have been attentively examined by us.

A brief memoir of the history of the railway and canal project for the Isthmus of Tehuantepec will be in place here. This isthmus has always, since the early days of American discovery, attracted attention and explorations, as one of the most available points for interoceanic communication; but the project for a "ship canal" first assumed a definite form in the report* by Senor Moro, founded on a survey made in 1842.

This survey originated in the concession by the Mexican government to Don Jose de Garay of the right to open a communication between the Pacific and Atlantic Oceans, through the Isthmus of Tehuantepec, coupled with the condition that the grantee "shall cause to be made at his own expense a survey of the ground and direction which the route should follow, and also of the ports which may be deemed most proper and commodious from their proximity."

Although the communication to be established was not necessarily to be a ship canal, or even (wholly) a water communication, yet it is evident that such a canal, or at least a great canal, was contemplated both by the Mexican government and the grantee; and the engineer, Moro, expressly states that to such a communication his attention was chiefly directed in making his survey.

In fulfillment of the obligation to make a survey, Senor de Garay immediately dispatched to the Isthmus a scientific com-

* "An Account of the Isthmus of Tehuantepec, with proposals for establishing a communication between the Atlantic and Pacific Oceans, based upon the surveys and reports of a scientific commission appointed by Don Jose de Garay. London, 1846."

mission, composed of Senor Gaetano Moro as chief, and Lieutenant-Colonel de Troupliniere and Captain Gonzales, of the staff corps, and Lieutenant Mauro Guido, of the navy, as assistants, and Don Pedro de Garay, an officer of the ministry of war, as secretary. The commission spent nine months upon the isthmus in the execution of its task. It fixed the position of the more remarkable points by astronomical observations or by triangulation, measured the most important altitudes by barometric or trigonometric observations, and explored in a general way the more important water-courses and harbors; and furnished, so far as it went, a tolerably accurate account of the isthmus in its geographical and topographical relations to the question of a canal, and gave very valuable information concerning the mineral wealth and the natural and agricultural productions.

Senor Moro based upon this survey a project for a canal of twenty feet in depth and fifty miles in length, connecting the upper waters of the Coazacoalcos, on the Gulf side, with the lagoons of the Pacific coast. The summit was at Tarifa, at about 680 feet above the level of the sea.

Further than to make the survey mentioned, nothing was accomplished by Senor de Garay with regard to executing the canal. After the acquisition of California by the United States, this route acquired a new importance as a means of communication with our newly acquired Pacific territory. Could possession have been obtained at once, Tehuantepec would probably have become the established route of communication, owing to the great saving of distance over Panama, as well as the salubrity of the climate.

Soon after the close of the war between Mexico and the United States, the franchises and privileges of Senor de Garay became the property of Mr. P. A. Hargous, of New York, who, in connection with a company formed in New Orleans, assumed the rights and responsibilities of the Garay grant. But the necessary negotiations with the Mexican government, and with other parties interested, delayed a commencement of operations till December, 1850, at which time the company, having applied to President Taylor for an officer of engineers to direct the survey, Brevet-Major J. G. Barnard, captain of engineers, was detailed for that purpose. The aspect of the problem was at this period

peculiar, the great object being to establish, at the earliest possible day, an available route for the great flood of travel between our Atlantic and Pacific coasts. Hence, the idea of a canal was put aside, and that of a railroad substituted. The survey then ordered was therefore organized and executed solely in reference to a railway and a preliminary and auxiliary wagon road, and these it was urgent to establish with the least possible delay. These facts not only shaped the whole character of the survey, but they even altered the route. It was necessary to extend these roads at once to the Pacific (instead of striking the lagoons, as the canal would do); and the "Ventosa," or "Salina Cruz," were the most available points for the Pacific terminus.

Instead of passing over Moro's summit (Tarifa), the more westward passes of Chivela and Masahua were surveyed. Hence the survey under Major Barnard not only did not coincide with Senor Moro's at the summit, but the entire route between the seas was quite different from that which a canal would occupy. The survey thus executed may be said to have been commenced in the end of December, 1850, and substantially terminated early in the following June (1851). Its results are so fully set forth in the report of the survey, prepared by J. J. Williams, one of the undersigned, that we need only state that it established the practicability of a railway route at moderate expense, and with grades not exceeding sixty feet per mile, and with a summit about 800 feet above the level of the sea. The passes surveyed were not supposed to be as low as the more eastern one of Tarifa, and no observations whatever were made specially directed to the practicability of a canal.

In the year 1857 the railway project was resumed, and a new survey executed under the direction of W. H. Sidell, now lieutenant-colonel of infantry and brevet brigadier-general, U. S. army, a distinguished civil and railway engineer, the object being a final location of the road. This latter survey was made with much care and expense. Upon its results and the previous surveys the line of location has been definitely laid down, the cost of construction estimated, and everything established necessary to the issuing of specifications for contracts for the execution of the work.

Since the revival, under the impulse of the successful execution

of the Suez canal, of interoceanic canal projects, the claims of the Isthmus of Tehuantepec for favorable consideration have gradually acquired a pre-eminence which was at first denied. The virtual failure of all the recent explorations instituted by the United States government to find a practicable route where the isthmus is narrow — as at Panama and Darien — and the superior advantage of geographical position of Tehuantepec, its healthfulness, and its vast local resources for the construction of such a work, and its established practicability, in an engineering point of view, for a canal with locks, are now understood, and must have their weight.

In describing the different surveys that have been made, we have reserved mention of the most recent; and, in reference to the establishment of the "practicability" which we have claimed for the canal project, the most important. We allude to the survey made during the last winter and spring by Captain R. W. Shufeldt, of the United States navy, by order of the President of the United States, in pursuance of an act of Congress for that purpose, and with the co-operation of the Mexican government, for the special object of determining the question of an adequate water supply.

The final report had not been transmitted to the Navy Department at the date of our leaving the United States, but the authenticated copies of preliminary reports have been furnished you by the honorable secretary of the navy, and are given in full in the appendix of this report.

We have in them, from the highest source and in the most positive form, the important conclusion "that an interoceanic canal of any necessary dimensions may be constructed across the Isthmus of Tehuantepec." We have also the further statement of the engineer, on whose exploration Captain Shufeldt bases his own dictum (just quoted), "that a ship canal across the Isthmus of Tehuantepec is not only practicable, but also that the topography of the country presents no extraordinary obstacles to its construction."

The latter statement, that "the topography of the country presents no extraordinary obstacles to the construction of a canal," is but a confirmation of the information obtained from Major Barnard's, Mr. Sidell's, and Senor Moro's surveys. The

railway surveys and location, passing over a line nowhere actually coinciding with the probable line of location of a canal, does not of course furnish the means of exhibiting a profile of such a location ; but most of the country through which it would lie has been traversed by Major Barnard's, Mr. Sidell's, Mr. Williams' or Moro's parties. Moreover, it should be borne in mind, unlike the country over which explorations have been recently carried across the Darien Isthmus, through wildernesses entirely unknown to civilized man, of which a single line of survey will furnish but very meager information, the Isthmus of Tehuantepec has been a thoroughfare for centuries, while for the last thirty years surveying parties have been, at intervals, traversing it from shore to shore, either with instruments of precision in their hands, or subjecting it to scientific reconnoissances. With these preliminary remarks, we will proceed to define the probable line of location for a canal, commencing at the summit.

The summit determined in 1842 by Senor Moro was near Tarifa. This selection was confirmed by incidental examination during Major Barnard's and Mr. Sidell's surveys,* and has now been once more confirmed by the survey of Captain Shufeldt. This summit level was barometrically determined by Senor Moro as being 680 feet (206 metres) above the level of the sea. The precise determinations of the elevation of the contiguous (railway) summits of Masahua and Chivela authorize the belief that the above statement of Moro is near the truth. The descent toward the Pacific plains (elevated at the foot of the mountains about 240 feet above the sea) would be either by the "Portillo

*"As principal engineer of the commission under Major Barnard, while making explorations and a survey for a railroad across the isthmus in 1851, I took occasion to examine the dividing ridge over which Moro had made his surveys for a ship canal in 1842 ; and although I did not pass over the entire route as surveyed by Moro for a ship canal, still I was at Tarifa, the summit, and on the most difficult ground over which he proposed to construct it, and I think I am safe in pronouncing the route, as surveyed by him, the most practicable of any yet explored."—*Report of J. J. Williams*, 1870.

It is also worthy of remark, that in the report of Major Barnard's survey the "Rio del Corte" was indicated by the same engineer as a probable source of adequate water supply for the summit level of a ship canal. (See page 245 of his report.)

de Tarifa," or (penetrating the small "Cerro del Convento") by the valley of the Monetza to its junction with the Chicapa, and thence by the valley of the latter river. The latter route furnishes the greater development (say ten or fifteen miles) for reaching the plains. Either route is believed to offer no extraordinary difficulties, though doubtless this descent is the most formidable work of the project. No tunnel is necessary, and the difficulties will lie in locating the bed and locks of a great canal along a descending mountain pass, in which the necessary excavations must be mostly in rock.

From Tarifa to the Portillo or to the Cerro del Convento, the distance is about four miles, measured over a plain so level that in the rainy season it becomes inundated. To depress the summit below the level of this plain would require a deep cutting, extending several miles. Such a cutting, even to the depth of a hundred feet, in relation to the magnitude and importance of the work, of which it would form an inconsiderable part, would hardly be thought formidable ; and the resulting advantage of reducing the number of locks, and placing the summit more conveniently in reference to its supply of water, may quite probably demand it.

We shall therefore assume that the canal summit is not over 600 feet above the sea. The descent to the plains at the foot of the mountains would therefore be about 360 feet, requiring thirty-six locks of ten feet lift. From the foot of the mountains the canal, descending through 240 feet with the natural slope of the plains, would reach the upper lagoon in a distance of about fourteen or fifteen miles.

The main source of water supply of the summit, as determined by the survey of Captain Shufeldt, will be from the upper waters of the Rio del Corte, at a point some twenty-five to thirty miles from Tarifa. The route of a feeder was carefully surveyed, with transit and level, by Mr. Fuertes, chief civil engineer under Captain Shufeldt, who found it entirely practicable. Mr. Fuertes finds the supply furnished by the Rio del Corte, and other available sources, at its lowest stage, to be 2,000 cubic feet per second, or 120,000 cubic feet per minute.

From the summit towards the Gulf of Mexico, the canal would follow the well-defined route of the valley of the Tarifa and

Chichihua rivers, to the junction of the latter with the Malatengo. Crossing the latter stream, it would strike the Coazacoalcos at Old Mal Paso, which river it would cross at that point.

The route from Tarifa to the Malatengo and Coazacoalcos is thus described by Señor Moro: "This part of the country is the most fertile and pleasant that it is possible to imagine. Shortly after leaving Tarifa, it is truly interesting to observe, mixed together, the spruce and fir tree of the cold climates, the oak of the more temperate, and the palm tree of the warm regions. Further on, these trees, as well as beautiful green meadows of vast extent, occur alternately with woods of a luxuriant tropical vegetation. Trees of precious woods, wild cacao, vanilla, etc., are everywhere seen. The plains near the rivers, cultivated by the inhabitants of El Barrio, Santa Maria Petapa and San Juan Guichicovi, give an idea of the astonishing fertility of the soil, since the natives only come in time to burn down the brushwood, and sow without cultivation, scarcely ever revisiting their cornfields until the harvest time."

Various considerations caused the left bank of the Coazacoalcos to be preferred for the railway surveys; but there is no doubt that the proper location of the canal is on the right bank. A diminution of length by some forty miles, the avoidance of transverse ridges (easily surmounted by a railway), the fewer crossings of streams and the avoiding of the overflows, are all considerations uniting in its favor.

From the lagoons to the summit at Tarifa, and from that point to the crossing of the Coazacoalcos, the line is so well defined as to leave but the mere details to be determined. From that point the canal, to avoid the great Suchil bend of the river to the westward, would follow, as near as practicable, its chord, crossing the Chicolote and the Chalchijapa, and approaching the Coazacoalcos again near the source of the Coahuapa. This region is a dense forest. Observations taken from the summit of Mount Encantada authorize the belief that it is unbroken by any great topographical irregularities. The only considerable streams to be crossed (this statement applies to the whole route) are the Malatengo, the Coazacoalcos, the Chicolote and the Chalchijapa. The second named is by far the largest. The ordinary rise and fall is seventeen or eighteen feet; but in excep-

tional seasons it is stated to have risen higher. The point of proposed crossing has been selected on a thorough knowledge of its favorable character.

From the Coahuapa to the junction and termination in the Coazacoalcos river, the proposed route lies through a country nearly level.

The entire length of purely artificial canal thus approximately located will be from about 115 to 120 miles. The number of locks would be 120 in all, assuming a summit of 600 feet, a lift of ten feet, and also, as we have a right to do, that there will be no secondary summits.

We have now to speak of the harbors. The Coazacoalcos, for thirty miles from the Gulf of Mexico, forms an excellent harbor. Its access is over a bar having thirteen feet at low water (according to the recent survey of Captain Shufeldt).* This bar is unchanging, and we anticipate no serious difficulties in attaining a navigable depth of twenty feet or upward. From the bar up to the point where the canal (as we have described its location) terminates, a distance of about thirty miles, the river is generally over twenty feet deep. At a few points there are but fifteen or sixteen feet depth. Of course, to adapt this portion of the river to a ship canal, will require channel improvements, and perhaps some rectifications in its course — no work, however, of great magnitude.

On the Pacific, the upper lagoon furnishes a basin in which, in the region occupied by the islands, and thence to the canal Santa Teresa, a depth of water of about twenty feet, with a mud and shingle bottom, is found.

To reach the ocean, one or both of the narrow peninsulas, which separate the lagoons from it, must be cut through, and an external harbor or entrance piers thrown out, similar to those now under construction at the North Sea terminus of the Amsterdam canal. The works at Suez, those at Amsterdam, and those of a very different character at the mouth of the Mass, yet having much in common with them, and that which we are now proposing, are sufficient proof that, to modern engineering, the

* The survey of Lieut. Leigh, U. S. Navy, in 1848, gave twelve and a half feet *at extreme low water of spring tides.* There has probably been slight if any change.

establishing of a good entrance to these lagoons, for vessels of large draught, is quite practicable.

In the railway surveys, it was important to reach the best existing port on the Pacific. Ventosa was first selected. Neither this point nor Salina Cruz is considered eligible for the canal, owing to the advantages the lagoons offer for a capacious harbor, and the diminution in length of artificial canal and avoidance of river crossings, but it is interesting to know that there are already secure anchorages in the close vicinity of our proposed entrance to the canal.

The statements given in the appendix, show that the formation of an external harbor on the Pacific coast, which will afford entrance to the lagoons, is fraught with no probable difficulties, and that the coast is not a dangerous one, and that there now exist in the close vicinity safe anchorages.

It would be quite premature to attempt an estimate for the work we indicate. Surveys of the line can alone determine the data upon which one can be made. But we state with confidence that, for the length of the line and height of summit, it is rare to find a route so devoid of engineering difficulties. Moreover, the isthmus furnishes every variety of building material while from its population, and that of the States of Oaxaca and Vera Cruz, can be drawn, at no expense for transportation, a hardy laboring force quite adequate to execute the work. The soil of the isthmus and of the contiguous regions affords, in abundance, sustenance for such a force. The climate throughout is healthy, even to European laborers. With a native force sickness is not to be anticipated. Hence, some of the most formidable difficulties and sources of expenditure in the construction of interoceanic routes, at other more southern points of the American isthmus, are not encountered on the Isthmus of Tehuantepec. The cost of earth and rock excavation or masonry should not exceed, on the isthmus, the cost of similar works in Europe.

In this connection we express our hearty concurrence with the views of M. Thome de Gamond, in his "Avant projet," for the Nicaragua canal, projected by M. Felix Belly. M. De Gamond says: "We think that, after the example of the Dutch and the Americans, it is important to make extensive use of timber

instead of masonry. The San Juan river traverses a virgin forest, furnishing trees of great dimensions, both in diameter and height. These timbers belong to the 'Concession,' and can be employed in unlimited quantity, with no other expense than that of the carpenters' work. To overlook the value of these gratuitous resources, and to prefer masonry merely because masonry is more durable and more monumental, would be to increase expense for an empty satisfaction."

Again, he says, "It would be an error to think that we can, in this enterprise, copy works executed in Europe under the formal rules of construction there adhered to. It is necessary, above all things, for the accomplishment of such an enterprise, to lay under contribution the immense local resources of nature, and to utilize in the employment of these resources that which is most applicable in the distinctive genius of every nation."

All that is said above by M. de Gamond applies perfectly to Tehuantepec. The immense forests of the most valuable and durable timbers which lie along the route should furnish the material for locks, bridges and aqueducts, by which the expense of these otherwise most costly structures will be reduced to a fraction of that which masonry would require.

The use of timber in the United States for locks and aqueducts and bridges is so common that we need not refer to examples ; to adopt its use at Tehuantepec is but to adopt the principle of M. de Gamond, and to apply the "distinctive genius" of American construction to an American work, and at the same time to "utilize" the immense constructive resources offered us in the forests of Tehuantepec.

In what precedes we have given no "dimensions" for the proposed canal. It would be premature in this report to do so. But it should be understood that we refer to a ship canal with an available depth of not less than twenty feet, and of locks of corresponding dimensions (say of 450 feet in length and fifty feet in breadth). The present transition state of ocean navigation, in which a substitution of steam for sails, and of steam vessels of enormous length for existing models, furnishes an independent and adequate motive for the use of timber for locks. While it would be imprudent to hamper navigation by "monumental" constructions of dimensions which might prove inade-

quate to the future, it would certainly be premature to build, in masonry, locks of the enormous length that some shipbuilders anticipate iron steamships are destined to attain.

We have but to add that the proposed railway, owing to local resources, and the extent of rich and productive countries which would become tributary to it, would command a lucrative traffic independent of interoceanic movements, and would be almost an indispensable auxiliary in the construction of a canal, in which capacity alone it would pay for its own construction.

We are, sir, respectfully, your obedient servants,

J. G. BARNARD,
Col. of Engineers, Bvt. Major-General U. S. Army.

J. J. WILLIAMS,
Chief Engineer, Tehuantepec Railway Company.

JULIUS W. ADAMS,
Engineer of Public Works, City of Brooklyn.

(*b*) Tehuantepec Railway and Tributaries.

Extracts from the report of J. J. Williams, upon the location of the Tehuantepec railway and tributary lines, 1870.

Leaving Minatitlan, the proposed head of present ship navigation, twenty miles up the Coazacoalcos river from the Gulf, the line takes the slope of the ridge north of that village, and passes just south of Cosuliacaque; thence just south of Tesistepec, following, with but slight variation, and for the purpose of correct alignment, the line of overflow; thence curving to the south and east of Lake Otiapa; thence curving southerly to the eastward of the hacienda of Almagro; thence nearly straight to within one mile west of Mount Encantada; thence curving westwardly and direct to the crossing of the Jaltepec river, about five miles west of Suchil, known as Hargousana. For this division of the road the line is quite direct, the curves of easy radius, and the grades gentle.

The principle governing in this location being to preserve the grade from about three to five feet above the level of extreme overflow, and at the foot of the slope of the high land which

constitutes the dividing ridge between the waters of the San Juan and Coazacoalcos rivers, and following this line, to preserve the shortest practicable route, to the crossing of the Jaltepec. At Hargousana the Jaltepec is crossed at the level of 110 feet above high tide at Ventosa. The line from thence south follows a depression in the ridge, and rises for one and one-half miles at the rate of sixty feet to the mile to the summit, which divides the waters of the Jaltepec from those of the Jumuapa river. This summit is just south of the Picadura to Suchil, and is 290 feet above high tide at Ventosa.* The line thence running southerly descends for eight miles, crossing several branches of the Jumuapa, until it reaches the latter at Paso de la Puerta, with no grade exceeding sixty feet to the mile. Crossing the river at this place at a height of 155 feet above tide, the line then follows a branch of the Jumuapa, which lies in the direction of the route to the summit between the valleys of the Jumuapa and the Sarabia, a distance of six miles, two miles of which is at the rate of sixty feet to the mile, with a total rise in that distance of 195 feet. From this summit the line continues direct to the Sarabia river, a distance of four miles, over a gently undulating profile, and crossing the latter river at a height above tide of 305 feet, or a fall of but forty-seven feet in four miles, curves to the eastward, and, following a branch of the Sarabia for two miles, with a rise of twenty feet per mile, reaches the summit between the Sarabia and the Malatengo rivers, at a height above tide of 340 feet; thence following a tributary of the Malatengo over a gently descending grade (Arroyo de los Venados, about two miles south of Boca del Monte), it crosses the latter river about 280 feet above tide, and near its junction with the Rio Almaloyo, and skirting the base of the upland between the two rivers, takes the valley of the Rio Almaloyo, which it follows to the plains of Chivela, a distance of twenty-four miles, rising in that distance 410 feet, or a mean rise of seventeen feet per mile, with no grade of over fifty feet per mile. Still following a branch of the Almaloyo, it crosses the Chivela plains and enters the Pass of Chivela at a height of 773 feet above tide, or a rise of eighty-three feet in four and one-half miles. This is the extreme height of the grade

* When reference is made to high tide, it means high tide at Ventosa.

at the summit pass which divides the waters which flow into the Pacific from those which flow into the Atlantic. From the summit of the Pass of Chivela for a distance of three and one-half miles the line descends a tributary of the Rio Verde on a grade of 116 feet per mile to the crossing of the Guichilona; thence by the valley of the Rio Verde three and one-half miles, on grades not exceeding fifty-three feet per mile, to Rancho de la Martar, at the base of the mountains on the Pacific plains. This point is 240 feet above high tide at Ventosa. The total distance from Minatitlan to Salina Cruz by this location is 162½ miles, which is composed of sixty-two miles on the Atlantic plains, sixty-six miles through the mountain division, and thirty-four miles over the plains of the Pacific.

The maximum grade is sixty feet per mile, excepting the grade through Chivela pass, which, ascending toward the Gulf, is 116 feet per mile, but only for a distance of three and one-half miles, and in operating the road an extra engine will be required to be used in assisting heavy northern bound trains over the summit. This should not be considered an unfavorable feature in the route, from the fact that on one of the greatest thoroughfares in the United States—the Baltimore and Ohio—the same grade was adopted in crossing the Alleghanies for a distance of sixteen miles.

The maximum curvature is seven degrees, or a radius of 819 feet, and this is only used in the pass of Chivela.

In estimating the cost of the Tehuantepec railway, I have before me the report of Major Barnard containing my original estimates, and also the reports of the chiefs of parties under Mr. Sidell. With these I am able to make the following approximate estimate of the cost of construction :

Auxiliary and carriage road between Minatitlan and the Jaltepec river	$62,000 00
Auxiliary road from the Jaltepec to Salina Cruz	41,000 00
Clearing, grubbing, graduation, masonry and bridging, Minatitlan to the Jaltepec	1,200,000 00
Clearing, grubbing, graduation, masonry and bridging, Jaltepec to Salina Cruz	4,120,000 00
Superstructure, Minatitlan to Salina Cruz	1,271,922 28
Stations, buildings and water fixtures	216,000 00

Engines and cars	$332,150 00
Engineering and contingencies, ten per cent	720,000 00
Total cost	$7,963,072 28

Or say, in round numbers, $8,000,000.

This is the maximum cost; but during the construction of the road, in working up the location, and in the modification of the grades, tangents and curves, for the minimum expenditure, it may be considerably reduced.

Article No. 23 of the general regulations governing the construction of all railroads in the republic of Mexico, gives the company the right to make such changes in the line of location as they may deem proper and useful. It is very seldom that a railroad is constructed without some modification of the original location.

* * * * * * *

As your instructions directed me to obtain as much additional information as possible, bearing on the subject of the railway across the isthmus, I take occasion to say that, notwithstanding all that has been said and written about Tehuantepec, I do not think that the isthmus has yet been fully described.

In the first place, a map should be made upon which can be laid down the coast and lateral railway lines which may be built to act as feeders to the main trunk line across Tehuantepec; and in order to do this the plan should include on the west as much of the States of Vera Cruz and Oaxaca as will take in the cities of the same names; on the east, the States of Tabasco, Chiapas, and a portion of Guatemala bordering on the Pacific; upon such a map should be projected the following connecting or branch lines. First, a road should be constructed from Medelin, already connected with Vera Cruz (twelve miles) by rail, to the harbor of Alvarado, a distance of about eighteen miles, over easy grades. Alvarado has one of the best harbors on the Gulf coast, and is about thirty miles from Vera Cruz.

The next should commence at or near San Nicholas, a hacienda on the San Juan river, at the head of steamboat navigation, about forty miles by water above the beautiful city of Tlacotalpan; thence by the valley of the same river fifty miles to the town of Paso San Juan; thence by the same valley thirty-five miles to Hargousana, on the Jaltepec river, there joining the

Tehuantepec railway. This line would comprise eighty-five miles of railway, and about seventy miles of inland navigation, and pass by the doors of the cities of Alvarado and Tlacotalpan. A good line may also be continued from the valley of the San Juan over an easy profile to Minatitlan, thus connecting the whole of the interior Atlantic slope of Mexico with its rich possessions on the Pacific coast by way of the proposed railway across the Isthmus of Tehuantepec, passing through one of the most productive regions in Mexico. To give you an idea of a portion of this route, I mention that when on my way down the San Juan river in a canoe, I estimated that about 100,000 head of cattle subsisted in this valley; but on our arrival at Tlacotalpan, Mr. Schleskie, one of the oldest, wealthiest and most respectable inhabitants of that place, informed me that I was entirely below the mark, and that there were at least 500,000 head in that and its connecting valleys. In the construction of the road this will be an important item.

The second branch railway should start from Rancho de la Martar, or from the point where the trunk line will enter the mountains from the Pacific plains, and run easterly down the coast, over nearly level ground, to the harbor of Tonala, and continue through that part of the State of Chiapas bordering on the Pacific to the frontier of Guatemala.

Such a line as this would put the Tehuantepec railway in direct communication with one of the richest and most beautiful countries on the Pacific coast. I was informed by intelligent gentlemen on the isthmus, who live in Chiapas, that that State alone produces on the Pacific coast, annually, about 5,000 bales of indigo, 5,000 bales of tobacco, 50,000 arobas of sugar, 5,000 bales of cacao, 15,000 bales india-rubber, 6,000 bales cotton, 6,000 sacks of coffee, 50,000 hides, to say nothing of the corn, ginger, vanilla, sarsaparilla, and the immense amount of Brazil wood and other valuable products, all of which will be sent to market over the Tehuantepec railway. The entire population and products of the Pacific slope, for some two hundred miles east and west of the isthmus, would find the same outlet to market; and, when the Vera Cruz and City of Mexico railway is completed, would be placed in direct and easy communication with the capital and the whole interior of the republic.

The third lateral railway should start on the Pacific coast, in the State of Oaxaca, at or near the outlet of the valley in which is situated the city of the same name, and run down to the harbor of Huatulco, thence to Salina Cruz, to connect with the Tehuantepec railway.

This would place the silver mining regions of the State of Oaxaca, as well as the city, in easy communication with the Gulf coast and the city of Mexico, by way of the Isthmus of Tehuantepec.

The great advantages of the proposed tributary roads are their extreme feasibility and the comparative ease and cheapness with which they can be constructed; the ground over which they would pass, for the greater portion of the distance, being nearly level plains.

The above, together with what has been said in Major Barnard's report, ought to convince the most skeptical that the *local business alone* would make the Tehuantepec railway a paying investment, to say nothing of the interoceanic traffic, from which a very large income may be expected with reasonable certainty.

(*c.*) Interoceanic Movements.

Extract from the report of J. J. Williams, on the location of the Tehuantepec railway and ship canal, 1870.

It is only necessary to look at a map of the world to be convinced of the immense relative advantages in position, above all others, which a ship canal across the Isthmus of Tehuantepec would offer to the commerce of the world, and more especially to that of the United States.

By this route the products of the valley of the Mississippi may be shipped from the Gulf ports direct for China, Japan, west coast of North and South America, and the islands of the Pacific; and the imports from those countries may be brought home to the ports of Texas, New Orleans, Mobile, Pensacola, and from thence transhipped to Memphis, Cairo, St. Louis, Louisville and Cincinnati, and be distributed throughout the Southern and Western States, even to the frontier of British

America, at one-third the cost of transportation of the same articles by the Pacific railroad. In a word, the completion of the ship canal across Tehuantepec will not only open a direct outlet from the Gulf of Mexico and the Atlantic to India and China, but also from the Mississippi river and tributaries, whereby the sea-going vessels plying upon those waters will be able to proceed with safety to any port on the Pacific; thus giving to St. Louis, the Queen City of the West, and the whole valley of the Mississippi, direct water communication with the Pacific side of North, Central and South America. In a word, the completion of the Tehuantepec ship canal would be the opening of the mouth of the Mississippi river into the Pacific ocean — another world of waters.

The isthmus belongs, in its greater part, to the State of Oaxaca, which has a population of 600,000, and the rest to the State of Vera Cruz, which has 300,000, and is bounded on the east by the State of Chiapas, which has 200,000. In these three States alone, from 8,000 to 10,000 good and hardy acclimated laborers, superior in strength and morality to the Chinese, can be had for less than fifty cents per day of twelve hours, and they board themselves; and, besides, from these sources, labor, to any extent that can be utilized, may be had from Tabasco and other parts of Mexico. This great enterprise itself would give work to thousands of the sons of that republic, now without employment, and, therefore, restless.

The following statement, condensed from official tables, shows the saving to the trade of the world, in insurance on vessels and cargoes, profits on time saved, interest on cargoes, saving of wear and tear of ships, saving of wages, provisions, etc., by using the Tehuantepec canal:

United States	$35,995,930 00
England	9,950,348 00
France	2,183,930 00
Other countries	1,400,000 00
Total yearly saving	$49,530,208 00

If the trade increases annually ten per cent, or one hundred per cent in the next decade, the saving to the world will then be double the above amount.

As the annual increase of the trade of Great Britain, France, and the United States, is, together, more than ten per cent, the saving to the maritime powers of the world of $49,530,208 in one year, at the end of ten years will be $99,060,416.* Assuming the trade only of the three powers to increase in the same proportion, the aggregate total amount saved at the end of ten years will be over $700,000,000.

Suppose the average tonnage of ships to be over 1,000 tons each, then, as per the tables in this report, 3,049 ships would be requisite to carry the freight, which would now annually seek the isthmus route. Abert, estimating for Darien or Panama, makes the annual saving for each ship $15,420, giving, as the aggregate saved upon the tonnage which would pass the isthmus, the sum of $47,709,480; and the saving of one year, at the end of ten years, would be $95,418,960; sums sufficiently near the first to establish their correctness.

Again, by a comparison of time and money, in the passage of a 1,000 ton ship from New York to California, *via* Cape Horn, with what it would be by way of Tehuantepec, it is estimated † that the saving on the ship and cargo would be $13,300, or thirteen dollars and thirty cents per ton, against a toll not to exceed two dollars and fifty cents per ton. Allowing the ships to make but four trips per annum, of forty-five days each, *via* the canal, it would give a yearly saving of $53,200. Deducting $10,000, the toll on the four trips, there results a net annual saving on a single 1,000 tons ship of $43,200.

Whale ships and coasting vessels have been estimated generally at forty dollars per ton. The United States and European commerce around the capes is conducted in first-class ships, which often cost eighty dollars per ton. Fifty dollars has, therefore, been taken as a fair average value, in the construction of these tables, which do not include coasting trade nor the trade of any of the powers of the world, except England, France and the United States.

* See Report of S. J. Abert, C. E., entitled "Is a Ship Canal Practicable?"

† Vide "Engineering," London, Vol. V, first half yearly.

The following tables show the trade of the United States, England and France, which would probably pass through the isthmus canal if now finished, taken from the official returns of 1857 and 1858:

Trade of the United States which must Pass through the Canal.

Countries traded with.	Tonnage.	Exports and Imports.
Alaska	5,735	$126,537
Dutch East Indies	16,589	904,550
British Australia and New Zealand	52,105	4,728,083
British East Indies	177,121	11,744,151
French East Indies	3,665	98,432
Half of Mexico	34,673	9,601,063
Half of New Granada	131,708	5,375,354
Central America	36,599	425,081
Chili	63,749	6,645,634
Peru	193,131	716,679
Ecuador	1,979	48,979
Sandwich Islands	33,876	1,157,849
China	123,578	12,752,062
Other ports in Asia and Pacific	4,549	80,143
Whale fisheries	116,730	10,796,090
California to East United States	861,698	35,000,000
Value of cargoes		$100,294,687
Total tonnage	1,857,485	
Value of ships at fifty dollars per ton		92,874,250
Total value of ships and cargoes		$193,168,937

Trade of France which would Pass through the Canal.

Countries traded with.	Tonnage.	Exports and Imports.
Chili	25,688	$10,000,000
Peru	35,096	13,160,000
Half of Mexico	10,004	2,790,000
Half of New Grenada	2,389	1,090,000
Ecuador	1,650	440,000
Bolivia	1,000	100,000
California	8,997	2,073,859
China (Outward only)	2,028	2,180,000
Dutch East Indies, (Outward only)	20,400	4,440,000

Sandwich Islands	4,119	$2,000,000
Philippine Islands	1,463	1,000,000
Australia	50,000	19,800,000
Value of cargoes		$59,073,859
Total tonnage	162,735	
Value of ships at fifty dollars per ton		8,136,750
Total value of ships and cargoes		$67,210,609

TRADE OF ENGLAND WHICH WOULD PASS THROUGH THE CANAL.

Countries traded with.		Tonnage.	Exports and Imports.
Half of Mexico		11,833	$2,775,137
Half of Central America		5,615	1,244,817
Half of New Grenada		10,188	2,437,605
Chili		118,311	15,486,110
Peru		224,319	20,473,520
Eucador		1,820	360,015
China	Outward only	16,853	7,077,390
Java	Outward only	16,003	3,821,410
Singapore	Outward only	16,500	4,364,070
Australia		522,426	78,246,095
Sandwich Islands		1,950	520,560
California		11,800	2,378,105
Value of cargoes			$139,184,834
Total tonnage		1,029,295	
Value of ships at fifty dollars per ton			51,464,750
Total value of ships and cargoes			$190,649,584

The value of the tonnage which would take the Tehuantepec route is, according to the above tables:

United States	$92,874,250
England	51,464,750
France	8,136,750
	$152,475,750

Total value of exports and imports, taking the same route, is:

United States	$193,168,937 00
England	190,649,584 00
France	67,210,609 00
Total value of trade of the three powers passing the isthmus	$451,039,132 00

Estimated tonnage to pass through the canal:

United States	1,857,485
England	1,029,295
France	162,735
Total tonnage	3,049,515

Upon the above tonnage, the yearly income, at two dollars per ton, would be $6,999,030, which is the estimated annual gross receipts from tolls upon ships belonging to the United States, England and France.

This calculation does not include the United States coasting trade on both oceans, nor the trade that might be expected from the other nations of the world not mentioned.

The amount of $2,500 toll, now charged on a ship of 1,000 tons on the Suez canal, would increase the above estimated yearly income on Tehuantepec to $7,625,000. This amount, based upon the yearly ten per cent increase, would double itself in ten years.

In 1860, the maritime movement between Europe and the East, by way of the Cape of Good Hope, amounted to 7,250,000 tons. The ascertained rate of progress would give for 1870 a total of 11,000,000 tons, one-half of which, at least, would pass through the Suez canal, and possibly a fifth by way of the American isthmus.

Taking these facts into consideration, and bearing in mind that none of the trade of the western hemisphere is included in the 11,000,000 tons, it remains for commercial men to say whether or not we are correct in estimating an annual amount of 3,000,000 tons as likely to pass through the American isthmus.

I have the honor to be, very respectfully,

Your obedient servant,

J. J. WILLIAMS,

Chief Engineer Tehuantepec Railway Co.